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EFFECT OF MITIGATING ENVIRONMENTAL POLLUTION BY INCORPORATION OF PHYTASE ENZYME IN FEED OF (ATHULYA) LAYER CHICKEN

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This study envisaged to asses and analyse the effect of phytase enzyme incorporation in the feed of layer chicken ATHULYA (ILM-90) to reduce phosphorus excretion through faeces and thereby control of environmental pollution. The study was conducted at AICRP(All India Coordinated Research Project) on Poultry, Mannuthy Thrissur, India. Addition of Phytase enzyme in the poultry feed significantly ($p<0.01$) reduced phosphorus excretion in the droppings of birds (g/Kg DM intake). Bioavailability of phosphorus in the enzyme treated groups was significantly improved. The effect of three levels of phytase viz., 200,300 and 400 units per kilogram in the low available phosphorus layer ration on comparison with birds reared on standard layer ration showed phosphorus availability to chicken in the enzyme treated groups were more , and hence excretion of phosphorus is reduced, which helps for control of pollution of nearby water sources.
Key words: - Phytase, Bioavailbility, phosphorus, environmental pollution

Eutrophication and several environmental pollution caused by the presence of excess quantity of phosphorous in poultry manure to the nearby water sources will be a significant problem in future as poultry industry is vibrantly fast growing in India at an annual growth rate of 8 – 10 percent. Lack of phytase enzyme secretion in the digestive system of birds, leads to do a study on the supplementation of Phytase through poultry feed on utilization of bound form of organic phosphorus present in the common poultry feed, thereby increasing the bioavailability of phosphorus and other minerals and also to reduce phosphorus excretion which is an eco-friendly factor in commercial layer operations.

MATERIALS AND METHODS

A study was conducted with one hundred and fifty white Leghorn strain across pullets ILM – 90 (ATHULYA) for a period of 20 weeks from 21st week to 40 week of age at All India Co ordinate research project on poultry improvement Mannuthy, Thrissur. The pullets there randomly divided into five dietary treatment groups viz.,standard layer ration(T1), low available phosphorus layer ration(T2) with available phosphorus at 0.3percent (whereas 0.5 percent in standard layer ration), low available phosphorus layer rations with 200,300 and 400 units of phytase per kg feed (T3,T4,T5), respectively.Each treatment had three replicates and ten birds in each replicate, thus fifteen different groups of birds were formed before starting experiment. Standard layer ration was formulated as per BAS specification for layer chicken. The enzyme used in this study was "Natuphos" – 5000 a product manufacture and marketed by M/S BASF, D-67056, Ludwigshafen, Germany.It is a phosphatase enzyme of fungal origin (Aperigillus species) containing phytase as the only component.While conducting the study birds were wing badged and housed in individual cages of identical dimentions. Feed and water were provided *ad libitum* throughout the experimental period. Uniform and standard manage mental procedures were followed during the course of the experiment.

At the end of the experiment, a metabolism trial was conducted for three days using four birds randomly selected from each treatment group. *Ad libitum* supply of feed and water was ensured. Feed

intake, excreta voided and dry matter content of the feed and excreta of individual birds were recorded for each day. The samples of droppings were taken and preserved for further analysis. Samples were pooled for each replicate and analyzed for calcium and phosphorus content. The chemical compositions like presence of total phosphorus and calcium content of droppings were analyzed as per the procedure described by AOAC (1990).

RESULTS AND DISCUSSION

In the present investigation, bioavailability of calcium as influenced by different feeding regimes was determined and is given in Table-1. It was numerically higher with both standard layer mash fed birds and birds fed low available phosphorus layer ration supplemented with 200 phytase units/kg(60.85 percent) and lowest with those fed on low available phosphorus layer ration without enzyme addition (57.68 percent).

Table-1-INFLENCE OF PHYTASE SUPPLEMENTATION ON BIOAVAILABILITY OF CALCIUM (Percent)

Bird's No.	**Treatments**				
	T1	**T2**	**T3**	**T4**	**T5**
1	58.93	56.06	62.87	60.85	58.87
2	62.74	58.23	59.56	61.17	62.13
3	60.02	58.92	60.30	58.13	57.53
4	61.71	57.50	60.66	61.93	58.96
Mean	60.85	57.68	60.85	60.51	59.37
SE	± 0.85	± 0.61	±0.71	±0.82	±0.97

Table-2-INFLENCE OF PHYTASE SUPPLEMENTATION ON BIOAVAILABILITY OF CALCIUM (Percent)-ANOVA

Source	DF	SS	MSS	F Value
Treatment	4	29.500	7.375	2.845NS
Error	15	38.859	2.593	
Total	19	68.389		

NS- Not Significant

Table-3-INFLENCE OF PHYTASE SUPPLEMENTATION ON BIOAVAILABILITY OF PHOSPHORUS (Percent)

Bird's No.	**Treatments**				
	T2	T2	T3	T4	T5
1	52.14	49.25	52.19	52.15	57.35
2	52.14	46.79	55.55	57.21	61.08
3	50.71	45.68	54.32	50.38	49.76
4	53.57	45.67	56.58	52.37	51.20
Mean	52.14^{A}	46.58^{B}	54.66^{A}	53.03^{A}	54.85^{A}
SE	±0.58	±0.84	±0.94	±1.46	±2.65

The data on bio-availability of calcium was subjected to statistical analysis and is presented in Table – 2. It showed that there were no significant differences among treatments.

Bioavailabilty of Phosphorus estimated in this study at the end of the experiment present in Table No.3 showed that it was highest (54.85 percent)for the birds fed low available phosphorus layer ration supplemented with 400 phytase units/kg (T5) and lowest (46.85 percent) with T2, ie. Birds fed low available phosphorus layer ration without phytase. In general the bio availability of phosphorus was more with

enzyme supplemented groups. Similarly it was more with standard layer mash fed birds than the negative control. The analysis of variance for bioavailability of phosphorus presented in Table – 4 showed that significant (P<0.01)differences existed among treatments .Significantly higher values were obtained for all enzymes supplemented groups as well as standard layer mash fed birds, whereas bioavailability of phosphorus was significantly inferior with low available phosphorus layer ration fed birds without phytase. It was also revealed that T1, T3, T4 and T5 were statistically comparable.

Table-4-INFLENCE OF PHYTASE SUPPLEMENTATION ON BIOAVAILABILITY OF PHOSPHORUS (Percent)

Source	DF	SS	MSS	F Value
Treatment	4	169.375	42.344	4.765**
Error	15	133.308	8.887	
Total	19	302.684		

**Significant (P<0.01)

Phosphorus excretion in faeces calculated as gram per dry matter intake is shown in Table- 5. Mean phosphorus excretion was 6.54, 5.30, 3.16, 2.96 and 2.89 per kg dry matter intake for T1, T2, T3, T4 and T5 respectively. Perusal of the mean phosphorus excretion data presented in Table 5 indicated that it was more among birds fed a ration containing 0.5 percent available phosphorus (T1) and that reduction of available phosphorus content of diet resulted in a simultaneous reduction of phosphorus excretion. It was also revealed that by the incremental addition of phytase to low available Phosphorous rations resulted in a linear decrease in phosphorus excretion.

Statistical analysis of the phosphorus excretion data given in Table 6 showed that this trait was significantly influenced by various treatments Phosphorus excretion was significantly influenced by various treatments.

Table-5-INFLUENCE OF PHYTASE SUPPLEMENTATION ON PHOSPHORUS EXCRETION (g/Kg DM intake)

Bird's No	**Treatments**				
	T1	T2	T3	T4	T5
1	6.10	5.25	3.23	2.78	2.95
2	6.70	4.52	2.92	3.30	2.84
3	6.76	5.41	3.68	2.46	2.69
4	6.58	6.00	2.82	3.30	3.08
Mean	6.54^{A}	5.30^{B}	3.16^{C}	2.96^{C}	2.89^{C}
SE	±0.15	±0.30	±0.19	±0.20	±0.08

CD=0.6066

Means bearing the same superscript do not differ significantly

Phosphorus excretion was significantly more with birds fed standard layer ration. Feeding of low available phosphorus ration resulted in a significant reduction in the phosphorus excretion. When phytase was supplemented to low available phosphorous ration phosphorus excretion was still reduced and was significantly different from other treatments. Phosphorus excretion of enzyme supplemented groups was statistically comparable.

Percent bioavailability of calcium and phosphorus presented in Table 1 and 3 respectively revealed that numerical difference existed between treatments. A reduction of 3.17 percent in the bioavailability of calcium was found when

the available phosphorus content of layer feed was reduced to 0.3 percent. When the low available phosphorus rations were supplemented with 200, 300 and 400 units of phytase/kg an increase of 3.17, 2.83 and 1.69 percent respectively of bioavailability of calcium among the treatments as influenced by phytase supplementation failed to show significant difference.

Table-6 INFLUENCE OF PHYTASE SUPPLEMENTATION ON PHOSPHORUS EXCRETION (g/Kg DM intake)-ANOVA

Source	DF	SS	MSS	F Value
Treatment	4	43.906	10.976	67.860**
Error	15	2.426	0.162	
Total	19	46.332		

**Significant (P<0.01)

Percent bioavailability of phosphorus was significantly influenced by phytase supplementation (P<0.01). Bioavailability of phosphorus was more in enzyme supplemented groups as well as in standard layer mash fed birds. Feeding layer with an available phosphorus content of 0.3 percent resulted in a significant reduction of bioavailability of phosphorus.

Schoner et al(1993) and Nahashon et al (1994) reported significant improvement in the retention of phosphorus when phytase was supplemented in layer diets. Zobac et al (1995) opined that feeding the diet low or devoid of dicalcium phosphate without Natuphos significantly reduced digestibility of calcium and phosphorus digestibility. Likewise, Gordon and Roland (1998) stated that inclusion of Phytase in layer diet improved calcium utilization. Carlos and Edwards (1998) also found that phytase enzyme had a positive effect on phytase phosphorus retention in laying hens. Based on the results of the present study and the findings of other workers it can be inferred that phytase supplementation on layers has a positive effect in improving the bioavailability of calcium and phosphorus. Addition of phytase in the diet acts upon the bound phytase phosphorus and liberated inorganic phosphorus molecules. It results in the enhancement of bioavailability of calcium and phosphorus.

Data on phosphorus excretion (g/Kg dry intake) as influenced by phytase supplementation given in Table-5 indicated that significant differences existed between treatments. Phosphorus excretion was significantly more (6.54 percent) with the birds offered a diet containing available phosphorus of 0.5 percent. When the available phosphorus content of the diet was reduced to 0.3 percent it resulted in a significant reduction in the phosphorus excretion (5.3 percent). Supplementation of phytase to the low available phosphorus diets also caused a significant reduction in the phosphorus excretion. It was also revealed that phosphorus of phytase supplemented groups were statistically comparable. It shows that when the birds are afford a standard layer feed containing an available phosphorus of 0.5 percent it results in more excretion of phosphorus since most of the plant phosphorus are in the form of phytase phosphorus and they are not utilized and hence excreted. It also shows that phosphorus excretion is less in diet containing an available phosphorus of 0.3 percent. It confirms that when phytase was added to diets it facilitates in enhancing the availability of phosphorus from phytase phosphorus for utilization and hence less amount is excreted in the droppings.

Reduction of phosphorus excretion in the droppings by phytase supplementation was reported by Schoner et al(1993), Kamiska et al (1996),Kwon et al (1995), Lettner et al (1995), Zobac et al (1995) and Harden and Wiedmer (1998). Thus supplementation of phytase not only is of important in enhancing the availability of phosphorus to bird but also is important in reducing environmental pollution by reduced phosphorus excretion.

Note:- This article is part of the M.V.Sc Thesis submitted to Kerala Agricultural University of the first author

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